NOAA Great Lakes Environmental Research Laboratory

Innovative Research for the Freshwater Seas

Executive Summary
STRATEGIC PLAN 2012

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Office of Oceanic and Atmospheric Research

A Message from the Director

The Great Lakes of North America – Superior, Michigan, Huron, Erie, and Ontario – contain almost 20% of the world's surface fresh water. The Great Lakes region serves as home to more than 30 million people. This unique ecosystem is defined by change, resulting both from natural processes still shaping a relatively young system, and from human activities. Unregulated dumping of toxic chemicals and phosphorus-rich waste in the mid-20th century polluted the Great Lakes and caused huge blooms of nuisance algae that washed up on beaches. In the late 1980s, non-native zebra and quagga mussels were introduced to the lakes in ballast water from oceangoing vessels, irreversibly altering habitats and food webs. Since its founding in 1974, The National Oceanic and Atmospheric Administration's (NOAA) Great Lakes Environmental Research Laboratory (GLERL) has been a leader in research to inform management in times of environmental change – from helping determine phosphorus load limits to studying the impacts of invasive species.

Today, the Great Lakes contain rapidly-changing ecosystems facing many challenges – but it is also a time of opportunity. The U.S. federal Great Lakes Restoration Initiative, begun in 2010, is an unprecedented investment in the future of the lakes and the human communities that depend upon them. Throughout the basin, fish and wildlife habitat is being restored, toxic areas are being cleaned up, and research is helping us to understand how best to protect and manage the Great Lakes.

Just like the lakes, GLERL has recently undergone a period of change. Since 2009, we have moved to a new facility, experienced a change in leadership, and implemented a new organizational structure. Although change can be difficult at times, it also creates opportunity. In 2010, an external review of the laboratory was conducted by a panel of esteemed scientists from across the country. In general, the reviewers recognized the importance of GLERL's research and the contributions of our highly skilled and talented workforce. The panel challenged us, however, to think more "boldly" to solidify GLERL's reputation as a leader in Great Lakes ecosystem research, modeling, and prediction. This Strategic Plan describes our bold vision for the future of GLERL research.

Throughout history, humans have been forced to react to environmental crises on the Great Lakes. It is imperative that we develop the ability to forecast environmental changes, so that managers can make proactive decisions guided by the best available science. GLERL is helping advance predictive management by developing ecosystem forecasts through a combination of environmental observations, ecosystem process studies, and integrated physical and ecological modeling. Our truly integrated, interdisciplinary science program is uniquely positioned to advance NOAA's mission to "understand and predict changes in climate, weather, oceans, and coasts" in the Great Lakes.

To develop this Strategic Plan, we worked closely with GLERL scientists and staff, NOAA leadership, and external partners, using NOAA's Next Generation Strategic Plan as a guide. An important component of GLERL's strategy is to track progress and evaluate success. Progress toward the goals in this Strategic Plan will be evaluated against specific milestones every six months. This accountability will ensure that our nation's investment results in the conservation and wise stewardship of the Great Lakes – one of its most precious natural resources.

Marie Colton

Dr. Marie Colton, Director

Executive Summary

The Great, Dynamic Lakes

The Great Lakes of North America contain almost one fifth of Earth's surface fresh water and drain more than 200,000 square miles of land. Human communities rely on the Great Lakes to provide ecosystem services such as food, clean drinking water, recreation, and cultural identity. Despite this, human actions have contributed to – and in some cases, accelerated – ecosystem change in the Great Lakes, with negative impacts to fisheries, habitats, and water quality. Today, the lakes are experiencing perhaps the most rapid and dramatic changes seen in centuries. Non-native species such as quagga mussels are drastically altering the structure of Great Lakes food webs and harming fish populations. Excess runoff of nutrients such as phosphorus is contributing to the largest toxic algal blooms ever recorded in Lake Erie, even more severe than those of the 1960s and 1970s.

For our region and the world to meet the challenges of today and the future, we must understand and anticipate the effects of stressors on the Great Lakes ecosystem and similar coastal and freshwater environments. For example, projections of future water levels under various climate change scenarios will help us better protect water resources and coastal communities. Predictions of the impacts of non-native species, such as Asian carps, will empower fisheries managers to respond quickly in the event of an invasion. Forecasts of harmful algal bloom conditions will keep beachgoers safe. Ecosystem forecasts will enable stakeholders to make informed, proactive decisions on the use, management, and enjoyment of the Great Lakes.

Mission

GLERL and its partners conduct innovative research on the dynamic environments and ecosystems of the Great Lakes to inform resource use and management decisions that lead to safe and sustainable ecosystems, ecosystem services, and human communities.

Vision

Reliable predictions of changes in interconnected natural and human systems contribute to the improved management of large lakes of the world and similar coastal ecosystems.

Leaders in Ecosystem Research

The National Oceanic and Atmospheric Administration (NOAA) is an agency in the U.S. Department of Commerce with a mission to "understand and predict changes in climate, weather, oceans, and coasts." NOAA's Great Lakes Environmental Research Laboratory (GLERL) in Ann Arbor, MI is uniquely positioned to carry out NOAA's important mission in the Great Lakes by conducting ecosystem research and providing forecasts. GLERL currently provides the Great Lakes community with innovative research, tools, products, and services that are improving our understanding and management of this unique, complex ecosystem. For example, GLERL scientists partner with NOAA's National Centers for Coastal Ocean Science, the NOAA Center of Excellence for Great Lakes and Human Health, and the Cooperative Institute for Limnology and Ecosystems Research to monitor and predict harmful algal blooms (HABs). In the summer of 2011, the Lake Erie experimental HAB "bulletin" provided up-to-date information and forecasts of bloom conditions to more than 400 stakeholders in the region.

Another example of GLERL's leadership is our long-term research program that has studied Great Lakes food webs and water quality for more than 30 years. This program uses monitoring and process experiments to understand how the ecosystem responds to stressors such as invasive species. GLERL scientists tracked the spread of the non-native quagga mussel and documented the simultaneous decline of *Diporeia*, an important source of food for fish. This information is vital to managers of recreational and commercial fisheries.

While maintaining core programs such as these, GLERL will expand upon this work in the coming years, guided by our new mission and vision.

Long-term strategic directions for GLERL's ecosystem research and forecasting:

- Invasive species
- Eutrophication
- Climate change

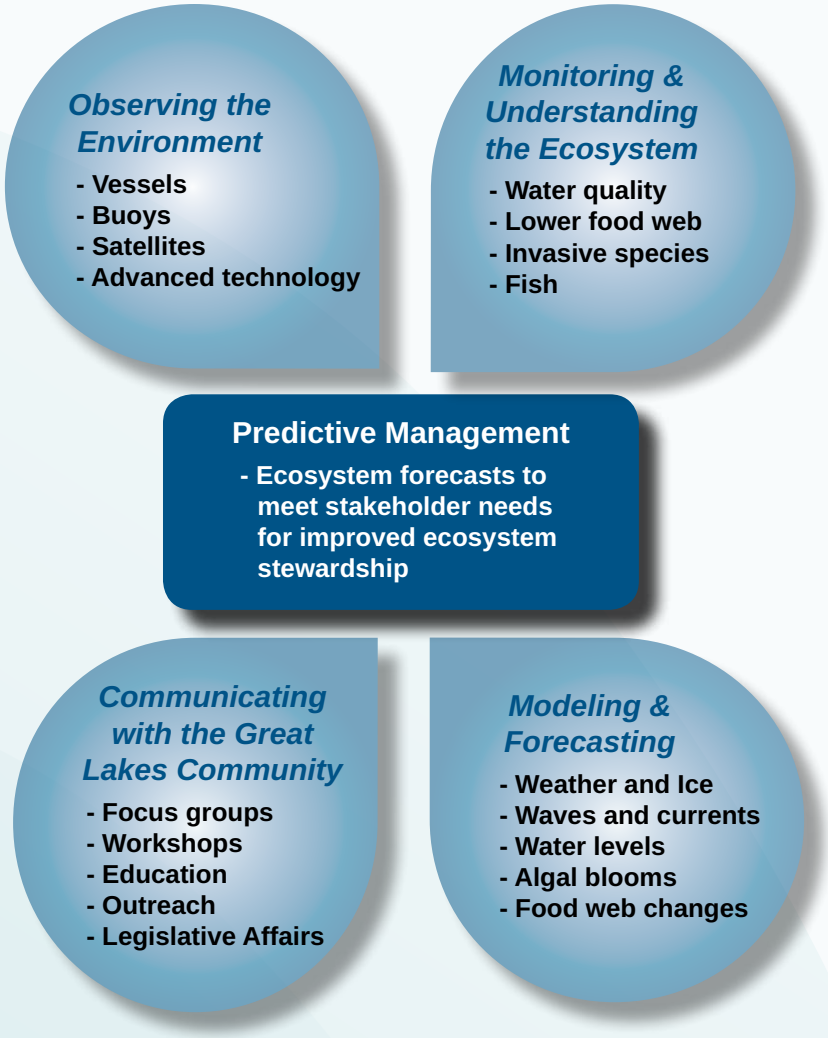
Near-term focus areas:

- Zebra and quagga mussel populations and their impacts
- Harmful algal blooms
- Hypoxia (oxygen depletion in bottom waters)
- Climate impacts on water levels and ice cover

GLERL's strategy for fulfilling our mission and vision is described in this Strategic Plan and summarized in the graphic below. The laboratory's integrated science program works across three thematic areas to:

1) observe the Great Lakes environment;
2) monitor and seek to understand critical ecosystem changes; and
3) develop models and forecasts of interconnected physical, biological, and ecological processes.

GLERL works with stakeholders to ensure that the laboratory's research meets their needs and that its products and tools are useful to inform decision making.



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GLERL's Ann Arbor facility

GLERL's Muskegon facility

Critical near-term actions:

- Expansion of long-term research program to Lake Huron
- Deployment of real-time, year-round observing systems
- Development of an Integrated Ecological Modeling Framework
- Acquisition of advanced field sampling equipment and new research vessel
- Hiring of strategic personnel:
  - Observing Systems & Advanced Technology Branch Lead
  - Harmful Algal Bloom/ Phytoplankton Ecologist
  - Research Physical Scientist (Modeler)
  - Benthic Ecologist

A Plan for Action

A team of 14 principal investigators and more than 50 other staff members work in science support, communications, and infrastructure at GLERL. The laboratory is a collaborative environment with co-located NOAA employees from the National Ocean Service, National Marine Fisheries Service, staff of Sea Grant and the Cooperative Institute for Limnology and Ecosystems Research, contractors, and students. Personnel are housed at a modern Ann Arbor facility and at the Lake Michigan Field Station in Muskegon. The Lake Michigan Field Station is home to GLERL's fleet of 13 research vessels, including the 80-foot R/V *Laurentian*, that support research on all five Great Lakes. GLERL's base budget of about $9.5 million is distributed across the three science themes using an annual, integrated planning process.

The 2012 Strategic Plan guides internal research plans and day-to-day operations by outlining the vision, goals, and objectives of GLERL's integrated science program. The plan contains an Implementation Strategy describing the critical success factors for the execution of our Science Strategy. Critical success factors include strategic leveraging of partnerships, integrated internal project planning, and high-performing facilities, equipment, and information systems, among others. We will revisit and update the science and operations milestones in this Strategic Plan every six months to track progress toward our goals.

GLERL 2012 Strategic Plan FULL VERSION

http://www.glerl.noaa.gov/about/history/strategic_plan.html